Bellcore

Developing Standards for LMDS

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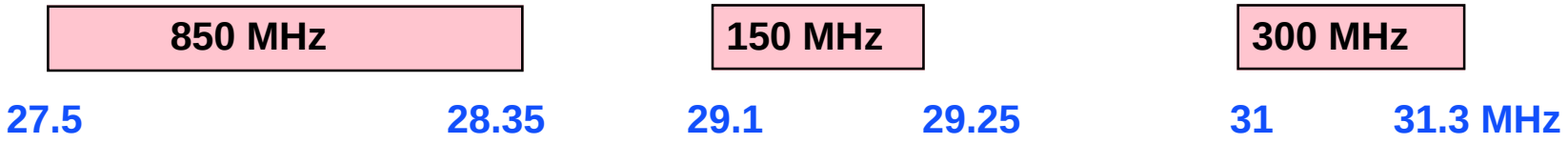
Outline

- LMDS architecture review
- Standards considerations
- What, when, why standardize
- A standardization approach
- Summary

LMDS Spectrum in The US

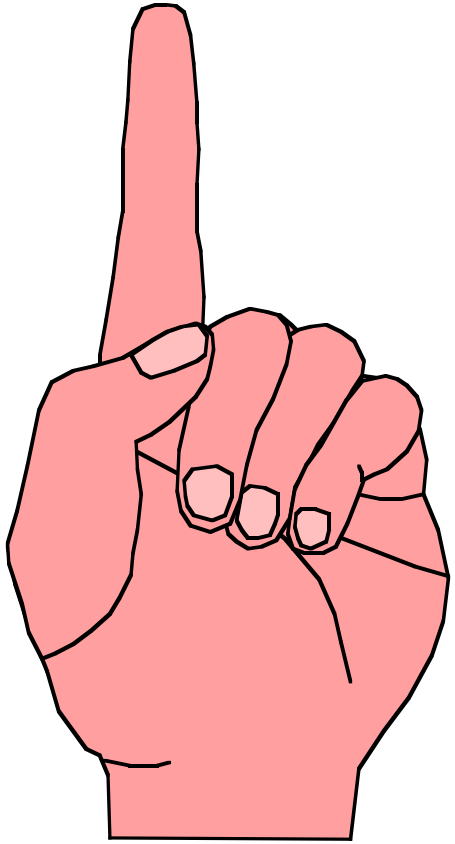
- Large Bandwidth (1300 MHz total)



- Two licenses per BTA, at 1150 MHz and 150 MHz
- Auctions completed March 25, 1998
- $578,663,029 spent on spectrum
- 93 winners for 864 licenses
- 379 Block A licenses covering 90% of pops and 485 Block B covering 99.5% of pops

Why Standardize

- ***Reduce costs*** **for equipment vendors by:**
  - **building to a defined set of specs**
  - **reducing development time**
  - **simplifying testing**
  - **producing larger volumes**
- ***Reduce costs*** **for service providers by:**
  - **having ability to mix and match**
  - **simplifying product evaluation**
  - **using a defined set of specs**
  - **reducing deployment time**
  - **simplifying testing**
  - **taking advantage of larger volumes**

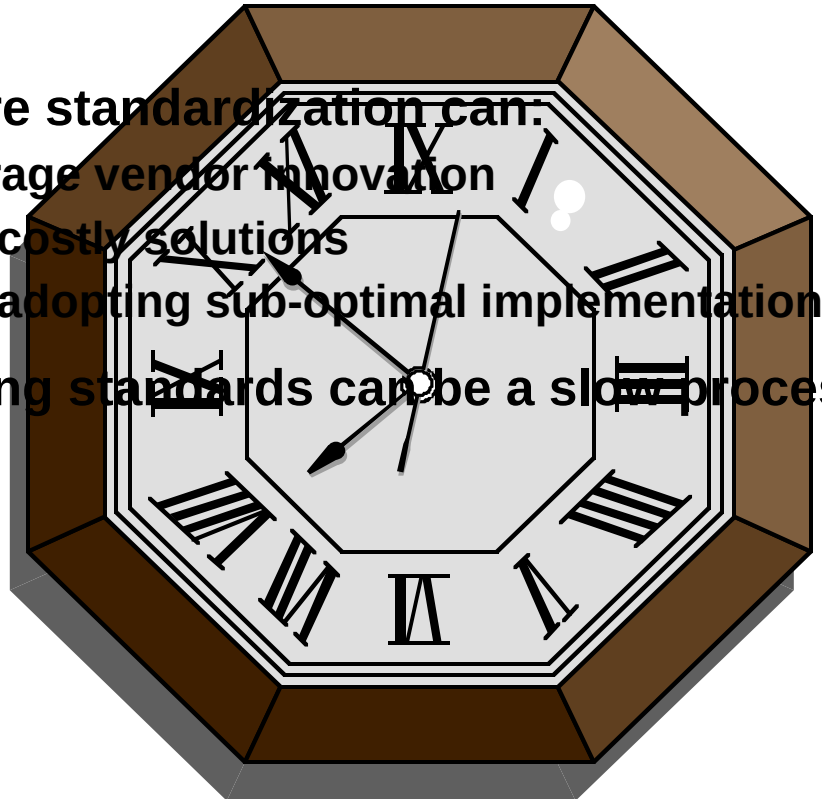


What to Standardize

- **Interfaces:**
  - **between hubs**
  - **between hub and subscriber**
  - **between subscriber outdoor unit and indoor unit**
  - **network interfaces**
  - **operations interfaces**
- **End-End-End Functionality**
  - **performance (BER, delay, synchronization...)**
  - **operations functions**
  - **Security and privacy**
  - **Emissions and radiation**
  - **etc.**

When to Standardize

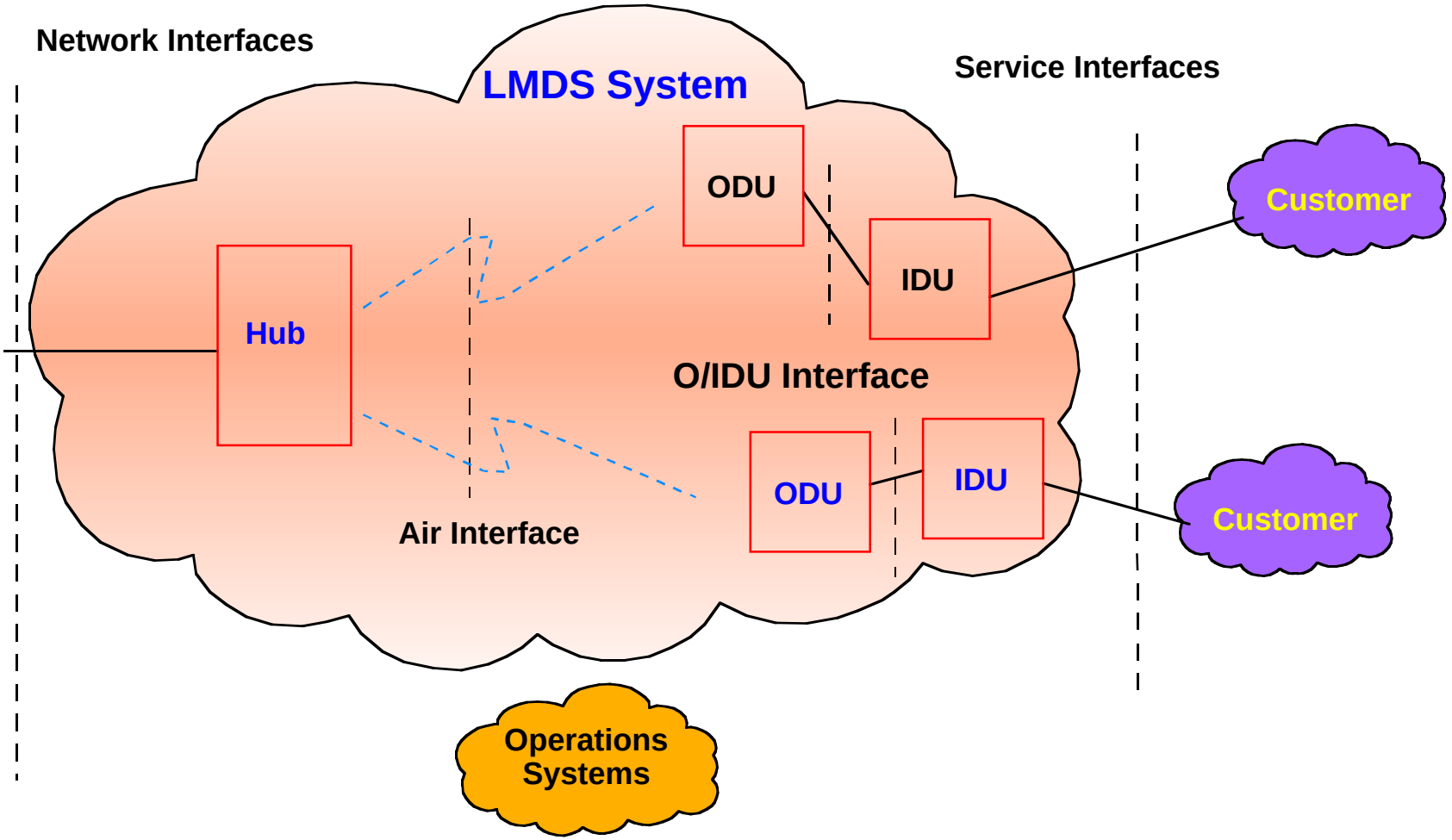
- Complete standards will be required when technology is mature
- Premature standardization can:
  - discourage vendor innovation
  - lead to costly solutions
  - lead to adopting sub-optimal implementations
- Developing standards can be a slow process
  -



LMDS Characteristics that Will Impact Standardization

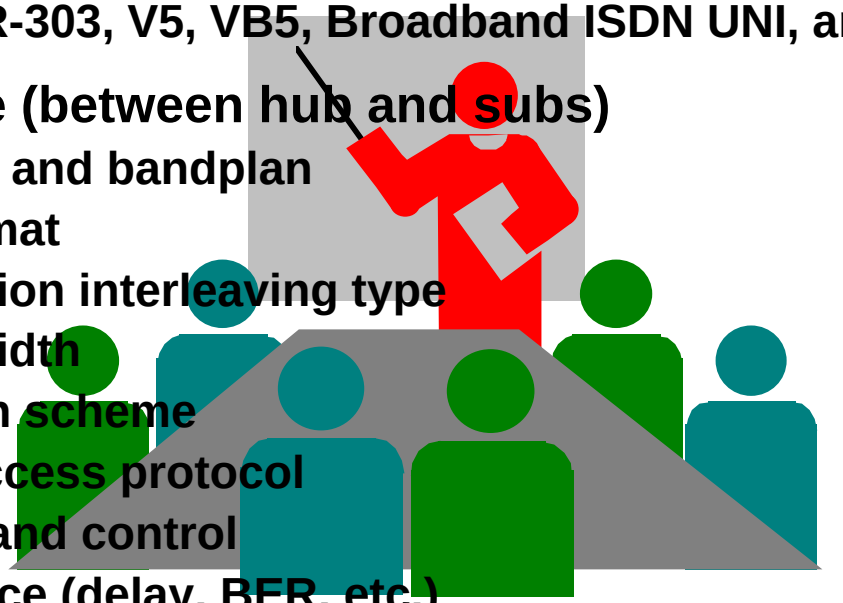
- Technology application too new
- Equipment not widely available
- Spectrum allocation not consistent from country to country
- Spectrum holders/service providers are concentrating their current efforts on building their businesses
- Equipment vendors concentrating their efforts on reducing costs
- Many existing standards may apply already

LMDS Standardization Areas



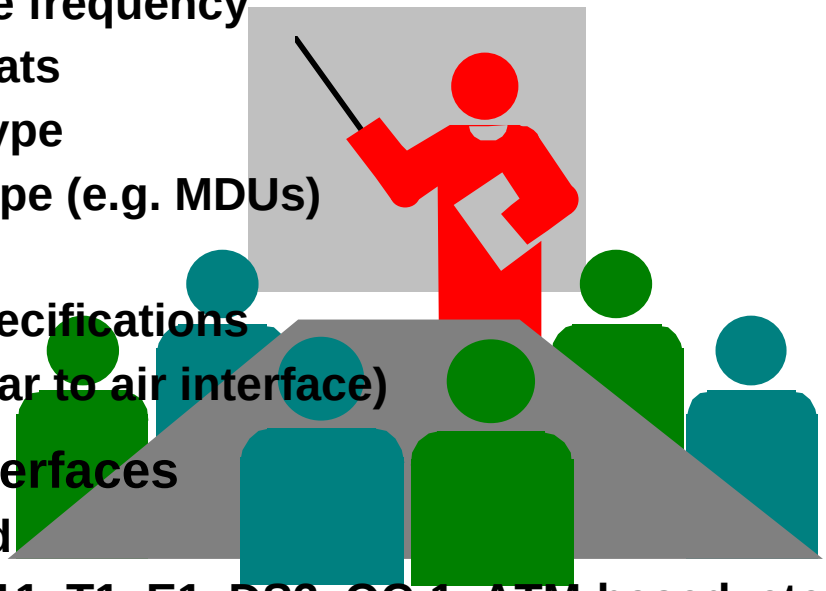
LMDS Standardization Topics

- Network interfaces
  - Well defined already
  - Include GR-303, V5, VB5, Broadband ISDN UNI, and NNI
- Air interface (between hub and subs)
  - Frequency and bandplan
  - Frame format
  - Transmission interleaving type
  - Channel width
  - Modulation scheme
  - Multiple access protocol
  - Signaling and control
  - Performance (delay, BER, etc.)
  - Operations functionality
  - Security
  - Redundancy
  - Other (e.g., physical layer, EMI, power control, etc.)



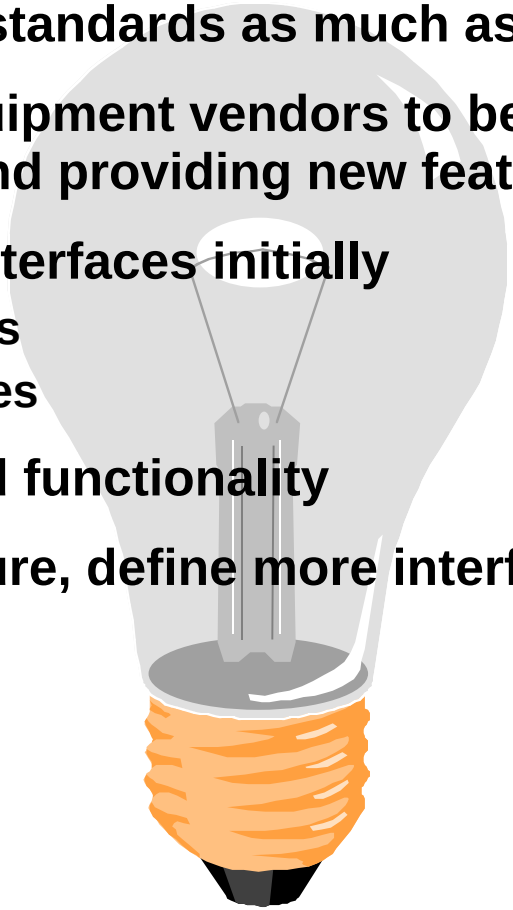
LMDS Standardization Topics -2

- Interface between outdoor and indoor units
  - Intermediate frequency
  - Frame formats
  - Customer type
  - Structure type (e.g. MDUs)
  - Powering
  - Physical specifications
  - Other (similar to air interface)
- Customer interfaces
  - Well defined
  - Include RJ-11, T1, E1, DS3, OC-1, ATM-based, etc.
  - May need to define new ones

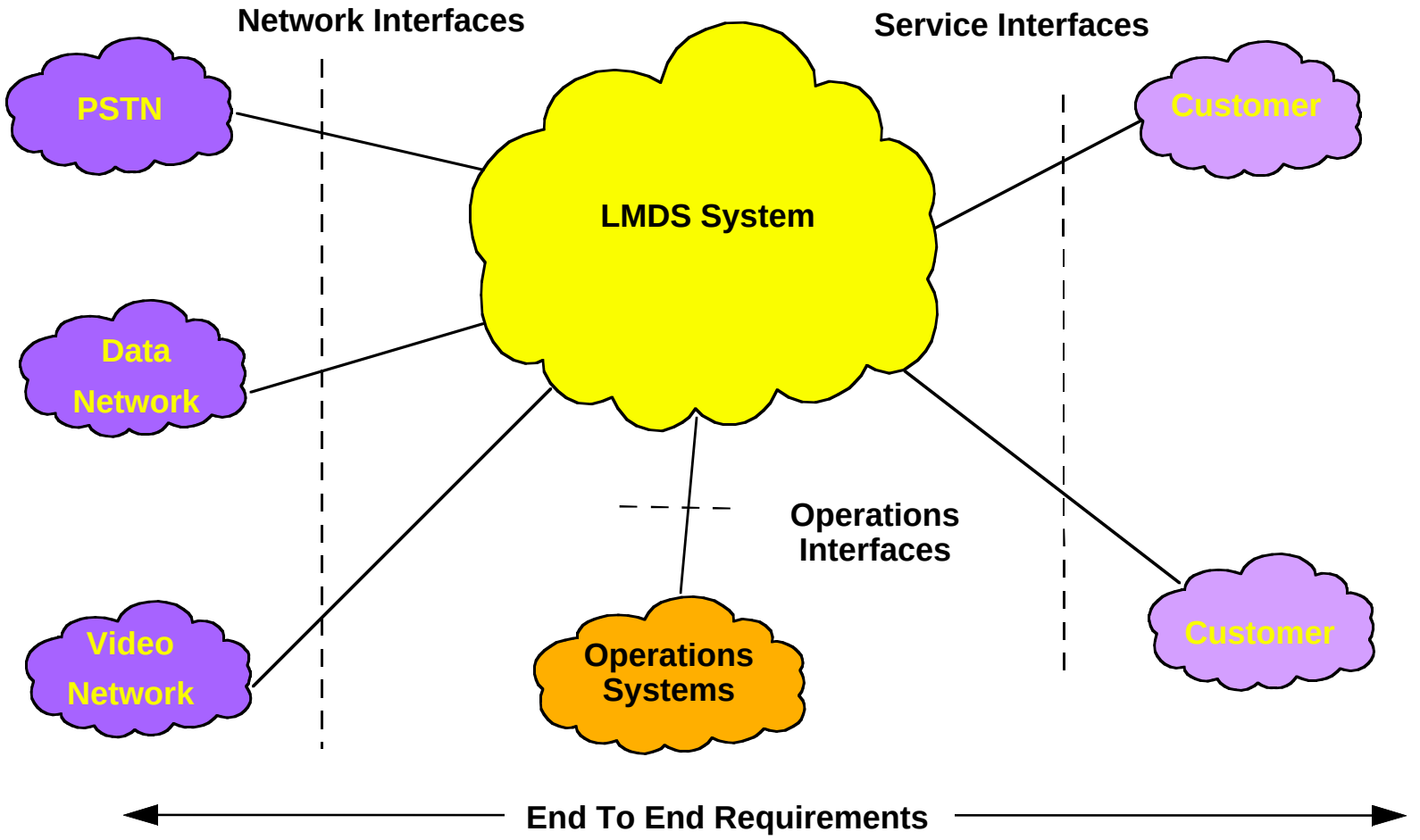


LMDS Standardization Approach

- Rely on existing standards as much as possible
- Allow system equipment vendors to be creative in reducing costs and providing new features and functions
- Define external interfaces initially
  - service interfaces
  - network interfaces
- Define end-to-end functionality
- As products mature, define more interfaces and more functions



LMDS Standardization Illustration



Summary

- **Standards are required to promote large volume productions and thereby reducing costs**
- **Premature standardization should not be encouraged**
- **Initial standardization efforts should take advantage of existing standards like ATM, service interfaces, etc.**
- **Other Wireless Broadband Systems should follow LMDS Strategy**